Neutrino Working Group Proto-Recommendations

1. The confirmation of the LMA solution for solar neutrinos opens the possibility of eventually measuring all of the lepton mixing parameters with accelerator experiments. These measurements fundamental and may shed light on the grand-unified scale and the hypothesis that leptogenesis may account for the matter-antimatter asymmetry of the universe. Fermilab should make these investigations a major portion of its future program.

2. The at each stage the optimum next step of this program will depend on the results of the previous stages. Thus, Fermilab should capitalize on its investment in the NuMI beamline and pursue a step-by-step approach.

3. From our present knowledge, the next step after the MINOS experiment will be the detection and measurement of $\nu_\mu \rightarrow \nu_e$ oscillations at the Δm_{atm}^2 scale. The off-axis proposal, which calls for a detector with ten times the MINOS mass, optimized for electron detection, and sited in an effectively narrow-band beam, appears to be a good choice for the next step. Fermilab should give the proposal careful attention.

4. All long baseline neutrino experiments will be severely statistics limited. Thus, following the recommendations of the Proton Driver Committee, we recommend that Fermilab give high priority to a proton driver and Main Injector improvements to provide a 2 MW proton beam at 120 GeV.

5. Long-drift liquid argon detectors are potential candidates for longer-term detectors in the NuMI beam line. Considerable R&D efforts will be required to demonstrate the feasibility of these detectors. At this time, the subcommittee does not have a consensus on the appropriate level of support that Fermilab should give to such an R&D program.

6. A well-designed reactor experiment with two detectors should be able to measure $\sin^2(2\theta_{13})$ with a precision of better than 1%. Such a measurement would be complementary to a NuMI off-axis neutrino measurement. Fermilab should continue exploring the prospects for conducting such an experiment in Illinois. If an Illinois site appears to be the best site for such an experiment, then it would be appropriate for Fermilab to play a major role in the experiment.

7. If $\sin^2(2\theta_{13})$ is less than about 0.005, a muon-ring neutrino factory will probably be necessary to complete the measurement of all of the neutrino oscillation parameters. R&D efforts towards such an accelerator are being conducted by an international collaboration. Fermilab should continue to participate in and support this R&D effort consistent with available resources and other priorities. At this time, the subcommittee does not have a consensus on the appropriate level of support.

8. The MiniBooNE experiment is currently searching for a short baseline oscillation signal in an effort to either confirm or refute the signal reported by the LSND experiment. A positive result would be evidence for one or more sterile neutrinos. Such a signal would require additional short and long baseline experiments to explore the additional parameters that sterile neutrinos would generate. Fermilab should be prepared to respond in an effective and timely way to such an eventuality.

9. The existing and planned neutrino beams at Fermilab will provide unprecedented new opportunities in high rate non-oscillation neutrino physics. A modest investment in new near-source detectors will be repaid handsomely in new physics from Fermilab and new physicists attracted to Fermilab. We encourage cooperation between the high energy and nuclear physics communities in planning the exploitation of this resource.